A Bi-Mix Antibacterial Drug-Delivery System for Regenerative Endodontics.

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Traumatic injuries to immature teeth have traditionally been managed via apexification therapy with intracanal calcium hydroxide/$Ca(OH)_2$. Recently, the use of a bi-mix (metronidazole-MET and ciprofloxacin-CIP) paste appears to provide more predictable results. The objective of this study was to fabricate/characterize polydioxanone (PDSII®)-based electrospun bi-mix drug-delivery systems incorporated with the combination of MET and CIP. The antibacterial property of the released media was tested against *Enterococcus faecalis (Ef), Porphyromonas gingivalis (Pg) , Aggregatibacter actinomycetemcomitans (Aa).* PDSII® was dissolved in HFP to obtain a 10wt.% solution. Either MET, CIP or distinct drug combinations were added into the solution followed by homogenization overnight. Six groups of study were employed: Control-100%PDS, G1-100%MET, G2-75%MET+25%CIP, G3-50%MET+50%CIP, G4-25%MET+75%CIP and G5-100%CIP. Electrospinning was done based on optimized parameters to fabricate the distinct samples. Uniaxial microtensile testing (n=10), Fourier transform infrared spectroscopy/FTIR, scanning electron microscopy (SEM), and agar diffusion assay were used to characterize mechanical, chemical and antibacterial properties. One-way ANOVA (only for fiber diameter), Kruskal-Wallis and Mann-Whitney tests were performed (α=0.05). The results showed that uniaxial tensile strength was not significantly decreased compared to the control except G3. Average fiber diameters were in the nano-scaled range and significantly lower then the control. SEM imaging indicated a submicron fibrous morphology. FTIR confirmed the characteristic peaks for PDS as well as for the employed drugs. Agar diffusion assay suggested that the higher the CIP concentration the greater the antibacterial property against *Ef, Pg and Aa*. The results indicated that higher amount of CIP (G4 & G5) did not compromise mechanical properties of nanofibers and showed the highest bacterial inhibition against *Ef, Pg and Aa*. Optimization of the physical-mechanical properties, kinetics of drug release, and the effect of released drugs on dental pulp stem cells are currently being pursued. Partially funded by American Association of Endodontists/AAE (M.C.B.).

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